

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of)
Guthrie, et al) Group Art Unit: 3729
Application No. 10/789,777) Examiner: TUGBANG,
) Anthony D.
Filed: 02/27/2004) Attorney Docket No.
For: ONE STEP COPPER) HIT1P057/HSJ920030250US1
DAMASCNENE CMP PROCESS)
AND SLURRY THEREFORE) Date: February 7, 2007

)

Amendment A

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Examiner:

In response to the Office Action mailed November 7, 2006, please consider the following election of claims.

LISTING OF CLAIMS:

This listing of claims will replace all prior versions of claims in the application:

- 1 1. (Withdrawn) A method of forming high aspect ratio copper structures,
2 comprising;
3 depositing a photoresist;
4 performing a reactive ion etch (RIE) process to form a trench;
5 depositing Cu;
6 performing single chemical mechanical polishing (CMP) process to remove
7 selected amounts of said photoresist and Cu.
- 1 2. (Withdrawn) A method as in claim 1 wherein said single CMP is performed
2 using a slurry comprising: SiO₂, Ammonium Persulfate, and Benzotriazole (BTA).
- 1 3. (Withdrawn) A method as in claim 1 further comprising depositing Al₂O₃.
- 1 4. (Withdrawn) A method as in claim 1 further comprising depositing a SiO₂ hard
2 mask, and wherein said CMP process removes said hard mask material at
3 substantially the same rate as said photoresist, and Cu.
- 1 5. (Withdrawn) A method as in claim 1 further comprising depositing a Ta barrier
2 layer, and wherein said CMP process removes said Ta at substantially the same
3 rate as said photoresist, and Cu.

3 Forming a magnetic pole structure;

4 depositing a photoresist;

5 depositing a hard mask;

6 patterning said hard mask to define a coil pattern;

7 performing a material removal process to form at least one trench according to
8 said coil pattern;

9 depositing Ta

10 depositing Cu; and

11 performing a chemical mechanical polishing (CMP) process using a slurry
12 comprising:

[3] Ammonium Ammonium Persulfate, Benzotriazole (BTA), and SiO_2

1 7. (Withdrawn) method as in claim 6, wherein said depositing Cu includes sputter
2 depositing a seed layer of Cu and then electroplating Cu.

1 8. (Currently amended) A method as in claim 6 further comprising adjusting a ratio
2 of Ammonium Persulfate and Benzotriazole (BTA) so that said CMP process
3 removes material from said photoresist, hard mask, Ta, and Cu at substantially the
4 same rate.

1 9. (Withdrawn) A method as in claim 6 further comprising forming a magnetic
2 pedestal and a magnetic back gap extending from said pole structure and wherein
3 a portion of said photoresist is deposited between said magnetic pedestal and said
4 magnetic back gap.

1 10. (Withdrawn) A method as in claim 10, wherein said magnetic pedestal and said
2 back gap comprise NiFe.

1 11. (Withdrawn) A method as in claim 6, further comprising performing said CMP
2 process sufficiently to form a substantially planar surface including said
3 photoresist, and said Cu.

1 12. (Withdrawn) A method as in claim 6 further comprising performing said CMP
2 process sufficiently to form a substantially planar surface including said
3 photoresist, said Cu and said Ta.

1 13. (Withdrawn) A method as in claim 6, further comprising hard baking said
2 photoresist before performing said material removal process.

1 14. (Withdrawn) A method as in claim 6 wherein said material removal process
2 comprises reactive ion etching (RIE).

1 15. (Withdrawn) A method as in claim 6 further comprising depositing alumina
2 (Al₂O₃).

1 16. (Withdrawn) A method as in claim 6
2 further comprising:
3 forming a magnetic pedestal and a magnetic back gap extending
4 from said pole structure; and
5 depositing alumina (Al₂O₃) and wherein:
6 a portion of said photoresist is deposited between said
7 magnetic pedestal and said magnetic back gap; and
8 said material removal process removes said material from
9 said magnetic pedestal, magnetic back gap, photoresist, hard mask,
10 Ta, alumina and Cu at substantially the same rate.

1 17. (Withdrawn) A slurry for use in chemical mechanical polishing, comprising:
2 SiO₂;
3 Ammonium Persulfate ((NH₄)₂S₂O₈); and
4 Benzotriazole BTA.

18. (Withdrawn) A method of forming a small Cu structure, comprising:
depositing a photoresist;
performing a material removal process form a cavity in said photoresist;
depositing Cu; and

performing a chemical mechanical polishing process using a slurry comprising:

SiO_2 Ammonium Persulfate, and Benzotriazole (BTA).